

GLASSY-WINGED SHARPSHOOTER STATEWIDE SURVEY & DELIMITATION PROTOCOLS AS OF 2002¹ (Revised March 2003)

SURVEY AREA

Counties within the potential range of the glassy-winged sharpshooter (GWSS) are designated as infested, partially-infested, or apparently free of GWSS. Counties and areas of counties are considered apparently free from GWSS if no established population (5 or more adults within any five-day period and within a 300-yard radius, or the presence of multiple life stages) can be found by survey.

Infested Counties

- Counties in which GWSS is generally distributed include Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties.
- GWSS survey activities in the infested counties are primarily associated with the certification of horticultural and agricultural commodities moving from an infested area into an uninfested area. Survey and monitoring guidelines for these commodities can be found in Nursery Shipping Protocols and compliance agreements.

Partially-infested Counties

- Limited infestations of GWSS occur in areas of Butte, Fresno, Kern, Imperial, Sacramento, Santa Barbara, Santa Clara, and Tulare Counties. Other areas of these counties have been surveyed and were found apparently free of GWSS populations.
- GWSS survey activities in the infested areas of partially-infested counties are primarily associated with the certification of horticultural and agricultural commodities moving from an infested area into an uninfested area. Survey and monitoring guidelines for these commodities can be found in Nursery Shipping Protocols and compliance agreements.

Counties Apparently Free of GWSS

- Counties in which GWSS is not known to occur include Alameda, Amador, Calaveras, Colusa, Contra Costa, El Dorado, Glenn, Humboldt, Kings, Lake, Madera, Marin, Mariposa, Mendocino, Merced, Monterey, Napa, Nevada, Placer, San Benito, San Francisco, San Joaquin, San Luis Obispo, San Mateo, Santa Cruz, Shasta, Solano, Sonoma, Stanislaus, Sutter, Tehama, Trinity, Tuolumne, Yolo, and Yuba.²

¹ Survey protocols in this document are intended to provide guidance on how to detect and delimit infestations of GWSS. Counties should consult with CDFA's Pierce's Disease Program before deviating from these protocols.

² Nine counties are deemed not at risk of becoming infested with GWSS due to unsuitable environments. They are the counties of Alpine, Del Norte, Inyo, Lassen, Modoc, Mono, Plumas, Sierra, and Siskiyou.

GWSS BIOLOGY

Hosts

- GWSS feeds on and oviposits in a wide variety of plants. The plants listed on the host list are those plant species on which GWSS life forms have been recorded in either California or the southeastern United States. This list is a working document and will continue to expand as more information becomes available. The most updated host list can be found on the internet at:

<http://pi.cdfa.ca.gov/pgm/manual/pdf/454/pdf> or 454/html

- Citrus is a favored host in southern California but very high sharpshooter populations also have been observed on avocado, crape myrtle, and several species of woody ornamentals. Other favored plants include eucalyptus and various members of the rose and mallow plant families. Native hosts include both evergreen and deciduous oaks, sycamore, and laurel sumac.

Life Cycle/Seasonality

- GWSS has two generations per year in California. Although adults are present and must feed throughout the year, egg-laying activities are either absent or reduced to very low levels during the winter months of December, January, and February. During this same period, the number of overwintering adults also decreases. Egg laying resumes in late February and continues through May. The first generation completes development from late May to late August. Adults from this generation lay egg masses from mid-June through late September, which give rise to overwintering adults.

SURVEY METHODS

Visual Searches

- Adults, nymphs, nymphal cast skins, egg masses, and egg scars can be found by visually searching plants. Inspections for egg masses and nymphs are best restricted to known oviposition hosts. Old egg scars are the easiest to detect since egg deposition sites are visible on both leaf surfaces. This is not always the case with newly laid eggs, as the raised surface blister (and characteristic waxy covering) is only visible on the undersides of the leaves. Consequently, a representative sample of leaves should be turned over and examined for egg masses. Backlighting against a sunny sky will also help in finding egg masses.
- When searching for active life stages on individual plants, certain behavioral characteristics of the sharpshooter can be used to increase the probability of detection. Important traits to consider are:
 - adults and older nymphs are primarily stem feeders
 - new flush growth is preferred
 - on trees, the insects usually select shoots that are growing upward (vertically oriented as opposed to horizontal twigs)
 - GWSS prefers southern exposures
- When populations are large and well established, adults are the easiest life stage to detect because they are highly visible when flying around or between their host plants. Flight activity is most pronounced during the late morning and afternoon hours; therefore, surveys should be conducted during the warmer parts of the day, if practical. Correct timing is particularly critical if adult numbers are low. At low densities and during cooler times of the day, nets may be used to agitate foliage causing adults to take flight.
- An efficient time period for looking at host plants is 10-15 minutes per urban property.

Nets and Beating Sheets

- Visual searches of host plants can be enhanced by using insect nets (aerial and sweep) and beating sheets. The effectiveness of these devices is largely dependent on the type and density of GWSS life stages present. Either aerial or sweep nets can be used to capture adults, but aerial ones are often more effective since they are lighter, more maneuverable, have larger openings, and are often equipped with longer handles. Retrieval of specimens from aerial nets is also more efficient as captured individuals are always visible.
- Sweep nets are constructed of sturdy, durable materials and designed to quickly sample a wide variety of short (generally four feet or less in height) woody and herbaceous plants, such as those found in nurseries. Sweep nets should always be used to augment visual examinations of plants since adults may be widely scattered and sitting on non-host plants. However, care must be exercised when using these nets so that plants are not injured. Sweeping is most likely to

capture adults and/or nymphs when temperatures are below 60°F. As temperatures warm, adults are less likely to be caught by sweeping but this activity will cause adults to fly making them easier to see. Adults can also be stirred up by agitating foliage with net handles or lightly jarring foliage or plant containers. Adults are usually difficult to net in flight so they should be followed to their landing sites, dislodged into a net, and then collected in alcohol.

- Beating sheets are also an excellent tool because they are more effective than sweep nets for direct sampling of highly suspect plant parts such as erect flush growth, and they enable rapid discovery of nymphs and their cast skins. They also help facilitate the capture of nymphs because nymphs often will remain on the sheet long enough to allow collection; they don't fly away. Beating sheets are most effective early in the day when temperatures are low and the insects are less active.

Traps

- Yellow sticky traps have proven successful at detecting infestations of GWSS. Panels measuring a minimum of 5" x 9" are the trap of choice for GWSS. Proper deployment is essential for trap capture success.
- GWSS adults have also been recovered from other sticky traps, i.e., Jackson trap inserts, suggesting that other traps with sticky components may also capture sharpshooters. Therefore, after removal from the field, all insect detection traps within the survey area should be routinely screened for GWSS. This includes all traps deployed for detection of exotic pests in urban areas including the sticky inserts from Jackson traps, any yellow stick panel traps, and Japanese beetle traps. We need to seek the cooperation of university extension and research personnel, private contractors and consultants (Pest Control Advisors), and growers who use similar traps for monitoring, controlling, or export certification in orchards, vineyards, and ornamental crops to be watchful for GWSS and notify the County Agricultural Commissioner should their trap capture GWSS.
- The flight temperature threshold for GWSS is approximately 65°F. Trapping will not be an effective survey method during periods when temperatures are lower than this threshold.

SURVEY PROTOCOLS FOR NON-INFESTED AND PARTIALLY INFESTED COUNTIES

URBAN AND RURAL RESIDENTIAL DETECTION SURVEY

Yellow Panel Traps

- Trapping Season: Begins no earlier than March 1 and ends October 31, depending on local conditions.
- Trap Density:
 - Urban residential (501 or more residences per square mile)
 - 5 traps per square mile
 - Rural residential
 - 301-500 residences/sq. mi. = 4 traps/sq. mi.
 - 151-300 residences/sq. mi. = 3 traps/sq. mi.
 - 51-150 residences/sq. mi. = 2 traps/sq. mi.
 - 25- 50 residences/sq. mi. = 1 trap/sq. mi.
 - Rural areas with 25 or less homes per square mile should not be trapped unless they are at risk for colonization by GWSS.
 - The number of traps recommended above should be doubled in the area within ¼ mile of high-risk nurseries³.
- Hosts: Preferred hosts should always be selected for trap deployment. Grape myrtle, when leafed out, is an excellent host and should be utilized when available. Other good hosts include the following:
 - Spring: Citrus, euonymus, and early stone fruits.
 - Summer: Apricot, carob, citrus, euonymus, grape, mulberry, plum, red bud, and sunflower
 - Fall: Citrus and eucalyptus.
 - Other locally favored hosts may be utilized for trap placement.
- Trapping Sites:
 - Irrigated areas with a diversity of plants which include multiple-preferred hosts should be selected whenever possible. Also, as lights may attract GWSS, place traps in suitable host plants near lights when possible.
 - GWSS trapping may be conducted as a separate activity or may be incorporated into general detection trapping activities, whichever is most appropriate for local conditions. However, GWSS traps should not be placed on the same host as medfly traps or other traps unless the same trapper is responsible for both trap lines. GWSS trappers will be trained to recognize detection target pests, since these may be captured on yellow panel traps. Most importantly GWSS trappers should always place their traps in the preferred hosts mentioned above.

³ High-risk nurseries are those which receive plant material from GWSS-infested areas.

- Trap Placement: GWSS are found primarily in the outer canopy of host trees. Traps deployed in individual trees should be positioned in a highly visible position (not hidden in the foliage) and placed in or near an area of vigorous, upright growth on the warmest part of the tree. If practical, traps can be hung on a pole in the open near a preferred feeding host.
- Trap Servicing Interval: Traps should be inspected every two weeks.
- Trap Relocation and Replacement: Every six weeks yellow panel traps should be relocated to another host at least 300 feet away. A new trap should be utilized at the time of each relocation. If traps are excessively dirty, they can be replaced at two to three week intervals.

Visual Surveys

- Season: March 1 through October 31.
- Sites: Visual surveys for all life stages of GWSS should be conducted in all at-risk ornamental plantings containing sharpshooter hosts. In general, targeted areas should include new residential developments, malls, industrial and community parks, golf courses, cemeteries, landscaped median strips, border plantings along major urban thoroughfares, and rights of way along major state highways. Right-of-way surveys are linear and should be treated as transects. Transects should be sampled at a minimum of five sites per linear mile each year. Grid surveys should be designed to adequately sample both the area and diversity of hosts found in each type of ornamental planting. Yellow panel traps may be utilized to augment visual searches via deployment in areas not sampled by the grid or transect.
- High-Risk Areas: Areas considered most at risk of becoming infested and their survey guidelines are as follows:
 - (1) Properties within $\frac{1}{4}$ mile of high-risk nurseries (i.e., nurseries receiving shipments from infested areas) are considered high risk. Annually survey 10% of these properties. This survey should be conducted during June, July, and August.
 - (2) Newly-landscaped commercial and residential developments. These should be monitored during planting and visually inspected once landscaping is completed.

URBAN AND RURAL RESIDENTIAL DELIMITATION SURVEY

Any detection of GWSS not associated with a recently-arrived nursery or landscaping shipment from an infested area shall trigger a delimitation survey. Due to the inability of the yellow panel trap to adequately (and rapidly) detect low-level populations, the following visual survey method shall be utilized.

Visual Survey

- All (100%) of the properties within a ¼ mile radius of the initial find shall be surveyed. Initial surveys should be door-to-door, moving outward in all directions from the original find site. If the infestation is highly localized the search area may be restricted to the area circumscribed by the original ¼ mile radius.
- Additional find locations shall be used as the epicenter to expand survey boundaries using a ¼ mile radius. If high or scattered sharpshooter populations are found in the initial inspections it may be advisable to conduct a “leap-frog” survey to rapidly determine the extent of the infestation. This involves running north, south, east, and/or west-oriented transects (as appropriate to the local conditions) and inspecting a minimum of ten properties per lineal ¼ mile. Continue inspecting outward until no sharpshooters are found on two consecutive blocks. Use the last block with finds to define the area to be subjected to a property-by-property search.
- When running transect surveys special bias should be placed on properties with highly favored hosts present (i.e., crape myrtle, citrus, red bud, carob, eucalyptus, etc.).
- Records of inspected properties should be maintained in such a manner as to prevent revisiting previously inspected ones during the follow-up 100% survey.

NURSERIES

Nursery stock represents a significant pathway for the introduction of GWSS into new areas. All nurseries that receive plant shipments from GWSS infested areas should be considered at high risk.

DETECTION SURVEY

Yellow Panel Traps

- Trapping Season: High-risk nurseries should be trapped year-round.
- Trap Density: Place 2 to 5 traps per acre depending on perceived risk.
- Hosts: Preferred feeding hosts should be selected whenever possible.
- Selection of Trapping Sites: Traps should be uniformly placed throughout the nursery. Place traps in each of the canopies when multiple plant canopies are present. Traps should be placed well within the nursery, not at the fence (property) line. Traps can be placed in/around holding areas designated for incoming shipments.
- Trap Placement: Position traps in the upper outer canopy, in a highly visible position (not hidden in the foliage) near vigorous, upright growth on the warmest side of the host. If plants are short, wooden stakes, poles, or rods can be used to secure the trap at or just above the canopy of nearby host plants.
- Trap Servicing Interval: Inspect traps weekly or biweekly at the discretion of the commissioner.
- Trap Relocation: Not necessary.
- Trap Replacement: Traps should be replaced every six weeks or sooner if needed.

Visual Survey

- Each high-risk nursery shall be visually surveyed once each year to confirm it is still GWSS-free. This inspection should be conducted during the summer months (June, July, August).

NURSERIES

DELIMITATION SURVEY

The detection of a GWSS not associated with a recent shipment from an infested area shall trigger a delimitation survey using the delimitation protocols outlined in the Urban Residential Section. All plants within the $\frac{1}{4}$ mile radius of the original detection site shall be inspected. This includes all plants within the nursery, and at or in any residences, croplands, or riparian habitats that fall within the designated delimitation boundaries.

Yellow Panel Traps

- **Trap Density:**
 - Core area [300-foot radius (8.3 acres or 600' on a side) centered on the GWSS detection site] = 10 traps/acre
 - Buffer zone (the area surrounding the core, formed by a 150-foot extension beyond the core area boundaries. This area is approximately 10.3 acres) = 5 traps/acre.
- **Servicing Schedule:**
 - First Week: Core traps checked daily; buffer traps checked twice per week.
 - Second Week: Core and buffer traps checked twice per week.
 - Third and Fourth Weeks: Core and buffer traps checked once per week.

If no additional GWSS are found, the trap density and servicing schedules will revert to detection protocols.

CROPLAND

DETECTION SURVEY

A cropland survey shall be conducted in the following areas:

- (1) Citrus orchards adjacent to packing houses, and host plantings (i.e., eucalyptus, oleander) along major routes used to transport citrus to packing facilities.
 - If traps are utilized, they should be deployed at a minimum density of one per 120 acres. Trap from April through October, relocating the trap into a new 20-acre subquadrant every six weeks. Service every two to three weeks. Use a new trap at the time of each relocation; replace traps as needed. Traps deployed in citrus should be placed in the upper canopy near flush foliage in exposed positions (not inside the foliage). Smaller rapidly growing trees inter-planted within groves of mature trees have also been observed with high numbers of adult GWSS and may represent the best sites for visual inspections or trap deployment.
- (2) All remaining citrus groves in each county, and any other established or new commercial plantings determined to be a risk by the county agricultural commissioner.
 - Deploy traps at a minimum density of one per 240 acres using the above guidelines for citrus. Trap from April through October, relocating the trap into a new 40-acre subquadrant every six weeks. Service every two to three weeks. Use a new trap at the time of each relocation; replace traps as needed.

The risk assessment of sites to be surveyed under subsection (2) shall be made by the agricultural commissioner in collaboration with PDCP program personnel.

Yellow Panel Traps

- Selection of Trapping Sites: If traps are deployed, sites should be selected along heavily traveled routes leading from infested sites. Traps should be placed at a minimum of two per lineal mile and deployed in the second border row in order to avoid exposure to dirt and dust along major routes. Trees next to citrus grove roads should be avoided. See below for trapping packing houses.
- Trap Placement: In orchards/groves, traps should be placed in the upper outer canopy in exposed positions near upright, vigorously growing foliage on the warmest side of the host plant. Smaller, rapidly growing trees inter-planted within groves of mature trees often are highly attractive to adult sharpshooters because of their flush growth. In vineyards, stakes or poles should be used to suspend the traps just above the leaf canopy.
- Trap Servicing Interval: Service traps every two to three weeks.

- Trap Relocation: Every six weeks into a new 20-acre subquadrant.
- Trap Replacement: Replace traps at six-week intervals or sooner if needed.

Other Crops

- Other crop plantings may be designated for survey based on the degree of risk as assessed by the local agricultural commissioner. Incorporation of these plantings into the county survey plan shall be made after consultation with, and approval by, PDP program personnel.
- Survey guidelines for these “at risk” plantings shall be determined by local circumstances but should minimally include:
 - Visual survey of 10% of each planting
 - Yellow panel trap monitoring at a density of one trap per 40 acres or less.

CROPLAND DELIMITATION SURVEY

Any detection of GWSS in cropland shall be delimited as outlined in the Urban Residential Section. This shall include all host crops as well as host materials found in dooryards or riparian habitats which fall within the prescribed survey boundaries.

Yellow Panel Traps

- Core (8.3 acres): Use 3 traps per acre (total traps required = 25).
- Buffer (10.3-acres): Use 2 traps per acre (total traps required = 20).
- Remainder of Block: Use 1 trap every 40 acres or less (total traps required dependent on size of planting)

NATURAL / RIPARIAN HABITATS

Surveys of natural/riparian habitats shall be at the discretion of the local agricultural commissioner in consultation with PDP project management. As a general rule only those natural areas which border new (three year old or less) developments would be considered for survey.

PACKING HOUSES AND PROCESSING FACILITIES

It has been suggested that hitchhiking adult GWSS may be transported to winery locations in gondolas of harvested grapes or to citrus packing houses via bins of citrus. Monitoring of wine grape gondolas in past years indicated that this may not be a viable, artificial pathway for movement of GWSS. However, GWSS has been found in citrus transport bins, and subsequently inside packing houses receiving those bins, when infested citrus groves are harvested during cool/cold weather conditions.

Yellow panel traps should be placed in and around citrus packing facilities throughout the harvest season, to serve as an early warning system to detect the presence of GWSS in incoming loads of citrus. Two to five traps per packing facility should be utilized.

GWSS SPECIMEN COLLECTION AND IDENTIFICATION

- All suspect GWSS specimens shall be submitted to the Plant Pest Diagnostics Center in Sacramento or submitted to the local county agricultural commissioner for submission to the Center for confirmation. This is particularly important for specimens which represent new distributional and host records and those which will be used as the basis for regulatory actions.
- Specimen Collection and Submission of Samples
 - Leaves with suspect viable egg masses should be placed in sealed plastic bags. Keep specimens as cool as possible.
 - Free-living adults and nymphs should be killed by placing them in vials containing 70% alcohol. These containers should have tight fitting corks or screw top lids to prevent the loss of specimens or preservative during transit to the laboratory.
 - Suspect adults on sticky traps can be submitted by either sending the entire trap or by cutting out and sending the portion of the trap containing the suspect sharpshooter. Do not cover trap surfaces with clear plastic. Prior to shipment, yellow panel traps should be reversed so that the sticky surfaces are on the inside and a rubber band placed around the outside to hold the two halves in position. Care should be taken to insure that the sticky surfaces are not in contact. Sticky traps should be placed in sealed plastic bag(s) before packaging. "Cut-outs" should be placed in dry plastic vials and sized to fit tightly inside so that neither the specimen nor the "stickem" comes in contact with the inner surface of the container.
 - Use a Standard Form 65-020, "Pest and Damage Record" (PDR), when sending specimens for identification.

QUALITY CONTROL OF GWSS TRAPPING PROGRAM

Maximizing the probability of GWSS detection using yellow panel traps requires that field personnel select good trap sites, properly place and service traps, keep complete and accurate records, and quickly recognize any trapped targeted insect pests. To evaluate these program elements, the PDP will institute a quality control program which includes the field inspection and evaluation of detection sites/traps, the examination of records at field stations and the periodic “planting” of sharpshooter specimens.